SIMPLIFIED INTERCONNECT FOR CENTER OF WIDE BODY AIRCRAFT

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a divisional of United States Patent Application No. 10/008,325 filed on November 7, 2001, and now issued as U.S. Patent No. _____, the disclosure of which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to brackets that are used to hold electric cables, and more particularly, to brackets specifically adapted for use in an aircraft that enables electrical cables on opposite sides of a panel in the aircraft to be interconnected.

BACKGROUND OF THE INVENTION

[0003] Commercial passenger airlines typically have multiple rows of passenger seats that are arranged in columns separate by one or more aisles. There are occasions when it is necessary to run electrical cables to the passenger seats in order to provide the passengers access to various services, such as telecommunications, lighting, audio/sound, broadband communications, etc. On aircraft that have the passenger seats arranged into columns separated by single aisles, the wiring typically enters the passenger compartment through openings located along the passenger compartment walls. Larger wide body aircraft, however, typically have multiple columns of seats separated by multiple aisles. In such aircraft it is difficult to effectively route the cables from the walls of the passenger compartment to the passenger seats located near the center of the aircraft because of the intervening aisle. One alternative would be to route the wiring through the floor of the passenger compartment rather than the walls. Accordingly, it would be desirable to provide a convenient and secure means for routing the electrical wiring through the passenger compartment floor on those aircraft that have more than one aisle separating the passenger seats.

SUMMARY OF THE INVENTION

[0004] In accordance with the present invention, a preferred embodiment of an electrical cable interconnect device for use in an opening in a panel of an aircraft is disclosed. The interconnect device comprises a bracket having at least one peripheral edge. The at least one peripheral edge is configured and adapted to attach to a first surface of the panel adjacent the opening. A plate having opposite first and second ends is attached to the bracket. The first end of the plate is attached to and extends along a portion of the at least one peripheral edge of the bracket. The second end of the plate extends through the opening in the panel. The plate has at least one opening that is configured and adapted to allow an electrical cable to be attached to the plate so that the plate facilitates interconnection of electrical cables on opposite sides of the panel. The interconnect device may have a cover. The cover is disposed on top of the bracket so that the bracket is between the cover and the first surface of the panel. The cover covers a portion of the opening in the panel. Optionally, but preferably, a portion of an edge of the cover is offset to form an access opening through which the at least one electrical cable can be routed. The access opening allows the at least one electrical cable to pass through the access opening and through the opening in the panel.

[0005] Preferably, the at least one peripheral edge of the bracket is a plurality of peripheral edges that are connected to form a generally rectangular shaped frame with a central opening. The peripheral edges are configured and adapted to attach to the first surface of the panel with the central opening in the frame generally aligned with the opening in the panel. A gasket can be interposed between the at least one peripheral edge and the first surface of the panel.

[0006] The interconnect device can also include at least one connector. The at least one connector has first and second ends and is attached to the plate so that the at least one connector extends through the at least one opening with the first and second ends on opposite sides of the plate. The first end is configured and adapted to connect to an electrical cable on one side of the panel and the second end is configured and adapted to connect to an electrical cable

on an opposite side of the panel so that the electrical cables on opposite sides of the panel can be conductively interconnected by the at least one connector.

[0007] Preferably, the at least one opening comprises at least one primary opening and a plurality of secondary openings. The at least one primary opening is configured and adapted to allow the at least one connector to extend through the at least one primary opening with the first and second ends of the least one connector being on opposite sides of the plate. The plurality of secondary openings are spaced about a periphery of the at least one primary opening and are configured and adapted to attach the at least one connector to the plate.

[0008] Even more preferably, the at least one connector is one of a plurality of connectors and the at least one primary opening is one of a plurality of primary openings. Each primary opening of the plurality of primary openings is configured and adapted to allow at least one connector of the plurality of connectors to extend through the primary opening with the first and second ends of the at least one connector of the plurality of connectors being on opposite sides of the plate. The plurality of secondary openings are spaced about a periphery of the plurality of primary openings and are configured and adapted to attach the plurality of connectors to the plate.

[0009] The present invention thereby provides an electrical cable interconnect device that can be used in an opening in a panel of an aircraft to interconnect electrical cables on opposite sides of the panel.

[0010] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0012] Figure 1 is a perspective view of a portion of a passenger compartment floor panel within a fuselage of an aircraft, wherein the floor panel has multiple access openings;

[0013] Figure 2 is an exploded perspective view of an electrical cable interconnect device of the present invention;

[0014] Figures 3A-E are partial views of various embodiments of the plate of the interconnect device of the present invention;

[0015] Figure 4 is a side view of an interconnect device of the present invention installed in a panel of an aircraft and showing the use of a strap to attach a connector with an attached electrical cable to the plate;

[0016] Figure 5 is a side view of an interconnect device of the present invention installed in a panel of an aircraft with radial connectors being attached to the plate and electrical cables being attached to the connectors;

[0017] Figures 6A-B are perspective views of two different types of connectors that can be used with the interconnect device of the present invention; and

[0018] Figure 7 is a side view of the interconnect device of figure 5 showing cables on opposite sides of the panel being interconnected by the interconnect device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

[0020] Referring to figure 1, there is shown a passenger compartment floor panel 20 having multiple openings 22 that are generally rectangular in shape. The openings 22 provide a means for routing cables 24, as shown in figure 7, through the floor panel 20 and into a passenger compartment of an aircraft. The number and the location of the openings 22 will vary depending on the requirements of the particular installation. While the opening 22 is shown and described as being rectangular in shape, it should be understood that other shapes are possible, and that the actual shape will depend in large part on the

requirements of the particular installation. For example, the opening 22 could be circular and still be within the scope of the invention as defined by the claims.

[0021] Referring to figure 2, there is shown an electrical cable interconnect device, generally indicated as 26, in accordance with a preferred embodiment of the present invention. The interconnect device 26 provides a convenient and secure means for interconnecting electrical cables 24 below the floor panel 20 to electrical cables 24 in the passenger compartment above the floor panel 20. The interconnect device 26 has a cover 28, a bracket 30 and a gasket 32.

[0022] The bracket 30 has at least one peripheral edge 34 that is adapted and configured to attach to a top surface 36 of the floor panel 20. Preferably, the at least one peripheral edge 34 is one of a plurality of peripheral edges 38 that are arranged to form a frame 40 with a central opening 42. Preferably, the frame 40 is shaped to be complementary to the shape of the opening 22 in the floor panel 20. The bracket 30 has a plurality of mounting holes 43 to attach the bracket 30 to the floor panel 20. When the bracket 30 is attached to the floor panel 20, the central opening 42 in the bracket 30 is generally aligned with the opening 22 in the floor panel 20.

[0023] A plate 44 having opposite first and second ends 46, 48 extends from the bracket 30 through the opening 22 in the floor panel 20. The first end 46 of the plate 44 extends along a portion 50 of the at least one peripheral edge 34 and the second end 48 of the plate 44 extends through the opening 22 in the floor panel 20, as can be seen in figures 4, 5, and 7. The plate 44 can be integral to the bracket 30, as shown in figures 2, 5, and 7. That is, the plate 44 can be a part of the bracket 30 and made from a single piece of material. For example, the bracket 30 and the plate 44 can be stamped from a single piece of sheet metal. Alternatively, as shown in figure 4, the plate 44 can be a discrete component separate from the bracket 30 that is attached to the portion 50 of the at least one peripheral edge 34 by a variety of means. For example, the plate 44 can be attached to the portion 50 of the at least one peripheral edge 34 of the bracket 30 by rivets, screws, adhesives, and a variety of other means that will be apparent to those skilled in the art.

[0024] The plate 44 has at least one opening 52. The at least one opening 52 is configured and adapted to allow an electrical cable 24 to be attached to the plate 44 so that the plate 44 facilitates the interconnection of electrical cables 24 on opposite sides of the floor panel 20. Preferably, the at least one opening 52 is one of a plurality of openings 54 in the plate 44. The openings 54 in the plate 44, as can be seen in figures 3A-D, can come in a variety of shapes and sizes depending upon the application in which the plate 44 is to be used and the desired method of attaching the cable 24 to the plate 44.

[0025] In a preferred embodiment, as shown in figure 4, a strap 56 is used to attach a cable 24 to the plate 44. The openings 54, as shown in figure 3E, are configured and adapted to receive the strap 56 to attach a cable 24 to the plate 44. The openings 54 can come in a variety of shapes, such as slots, to facilitate the use of a strap 56 to secure the cable 24 to the plate 44. The strap 56 can come in a variety of forms as will be apparent to those skilled in the art. For example the strap 56 could be a tie wrap that goes through the openings 54 in the plate 44 and secures the cable 24 to the plate 44. The strap 56 could be a metal wire or twist tie that secures the cable 24 to the plate 44. The strap 56 could also be an elastomeric band that retains the cable 24 against the plate 44. The strap 56 could also come in the form of a clip that fits into one or more openings 54 and secures the cable 24 to the plate 44. Therefore, the strap 56 can come in a variety of forms and still be within the scope of the invention as defined by the claims.

[0026] When the cable 24 is attached to the plate 44 with a strap 56, it is preferred that a protective member 58 be positioned between the cable 24 and the plate 44 and/or the strap 56 to protect the cable 24 from being damaged by the plate 44 and/or the strap 56. The protective member 58 can come in a variety of forms. For example, as can be seen in figure 4, the protective member 58 could be a sleeve in which the cable 24 is inserted so that the protective member 58 is in contact with the plate 44 and the strap 56. The protective member could also be in the form of a sheet or strip that is placed between the cable 24 and the plate 44 and/or the strap 56. Preferably, the protective member 58 is made from a phenolic material. However, it should be understood that the shape and form of the protective member 58 and the material out of which the

protective member 58 is made can be varied, as will be apparent to those skilled in the art, without departing from the scope of the invention as defined by the claims.

[0027] In an alternate preferred embodiment, the cables 24 are attached to the plate 44 by means of a connector 60. The connector 60 has first and seconds 62, 64 that are configured and adapted to connect to electrical cables 24, as is known in the art. The at least one opening 52 in the plate 44 is configured and adapted to secure the connector 60 to the plate 44 with the first and second ends 62, 64 of the connector 60 being on opposite sides of the plate 44, as can be seen in figure 5. The connector 60 can come in a variety of forms, as will be apparent to those skilled in the art. For example, as can be in seen in figure 6A, the connector 60 can be a radial or barrel connector 60. When the connector 60 is a radial connector 60, the at least one opening 52 in the plate 44 is generally circular in shape, as can be seen in figure 3A. The radial connector 60, as shown in figure 5, extends through the at least one opening 52 in the plate 44 and has a cable 24 attached to the first end 62. The connector 60 can be secured to the plate 44 by a variety of means, as is known in the art. For example, the radial connector 60 can have a threaded portion 65 that extends through the at least one opening 52 in the plate 44 so that nuts 66 can be positioned on the radial connector 60 on opposite sides of the plate 44 and secure the radial connector 60 to the plate 44. The connector 60 can also be designed to be press fit or snapped into the at least one opening 52 in the plate 44. When the connector 60 is press fit or snapped into the at least one opening 52, the connector 60 preferably has tabs (not shown) that retain the connector 60 in the at least one opening 52 in the plate 44, as is known in the art. As can be seen in figure 7, the connector 60 conductively interconnects cables 24 above and below the floor panel 20. The attachment of the cable 24 and/or the connector 60 to the plate 44 minimizes the possibility of the interconnected cables 24 from becoming inadvertently disconnected. Preferably, the at least one opening 52 is one of a plurality of openings 54 so that more than one set of cables 24 can be interconnected, as shown in figure 7.

[0028] In another alternate preferred embodiment, as can be seen in figures 3B-D, the at least one opening 52 in the plate 44 comprises at least one

primary opening 68 and a plurality of secondary openings 70. The at least one primary opening 68 is configured and adapted to allow one or more connectors 60 to extend through the at least one primary opening 68 with the first and second ends 62, 64 of the connectors 60 being on opposite sides of the plate 44. The plurality of secondary openings 70 are spaced about a periphery of the at least one primary opening 68. The plurality of secondary openings 70 are configured and adapted to attach the connector(s) 60 to the plate 44. For example, when the connector 60, as shown in figure 6B, has a plurality of openings 72 spaced around a periphery of the connector 60, the connector 60 can be attached to the plate 44 by inserting the first or second end 62, 64 of the connector 60 through the at least one primary opening 68 and aligning the plurality of openings 72 in the connector 60 with the plurality of secondary openings 70 spaced about the periphery of the at least one primary opening 68. The alignment of the plurality of openings 72 in the connector 60 with the plurality of secondary openings 70 in the plate 44 allows the connector 60 to be attached to the plate 44 by means of mechanical fasteners (not shown), such as screws or rivets, or by other means, as are known in the art and as will be apparent to a skilled practitioner. Alternatively, the connector 60 could have a plurality of projections (not shown) that extend from the connector 60 in the locations where the plurality of openings 72 are located. The projections align with the plurality of secondary openings 70 when the connector 60 is inserted through the at least one primary opening 68. The projections are pressed into the plurality of secondary openings 70 on the plate 44 to secure the connector 60 to the plate 44, as will be apparent to those skilled in the art.

[0029] Preferably, the at least one primary opening 68 is one of a plurality of primary openings 74. Each primary opening 74 is configured and adapted to allow at least one connector 60 to extend through the primary opening 74 with the first and second ends 62, 64 of the connector 60 being on opposite sides of the plate 44. The shape and configuration of the primary openings 74 will depend upon the type of connector 60 that is going to be used to secure the cable 24 to the plate 44. For example, as shown in figure 3B, when the connector 60 is a radial or barrel connector 60, the primary openings 74 are circular. When the connector 60 is a D-subconnector, the primary openings 74

are generally trapezoidal in shape, as shown in figure 3C and as is known in the art. The primary openings 74 can be generally U-shaped openings 75, as shown in figure 3D. The U-shaped openings 75 are designed to accommodate more than one connector 60 in each of the U-shaped openings 75. The U-shaped openings 75 shown in figure 3D are configured and adapted to receive three D-subconnectors 60 in each of the U-shaped openings 75. Each of the primary openings 74 has a plurality of secondary openings 70 spaced about the periphery of the primary openings 74. As was discussed above, the secondary openings 70 are configured and adapted to attach the connector 60 to the plate 44.

[0030] Referring now to figure 2, the cover 28 is shaped to be complementary to the bracket 30 and the opening 22 in the floor panel 20. The cover 28 has a raised area 76 on the top surface 78 of the cover 28. The raised area 76 of the cover 28 is preferably along an edge 80 of the cover 28. The raised area 76 is offset from the top surface 78 a predetermined distance 82 and forms an access opening 84. The offset distance 82 is preferably only slightly larger than a maximum diameter of a cable 24 that will be routed through the access opening 84. The raised area 76 preferably extends away from the edge 80 a sufficient distance to allow the cables 24 to pass through the access opening 84 and be interconnected to cables 24 below the floor panel 20 without having to bend sharply. A width (not shown) of the access opening 84 created by the raised area 76 can vary depending upon the number of cables 24 being routed through the access opening 84. The cover 28 has a plurality of mounting holes 86 spaced along a periphery of the cover 28 for attaching the cover 28 to the floor panel 20. The mounting holes 86 in the cover 28 align with the mounting holes 43 in the bracket 30.

[0031] The gasket 32 is complementary to the peripheral edge 34 of the bracket 30 and to the opening 22 in the floor panel 20. The gasket 32 is positioned around a periphery of the opening 22 in the floor panel 20 and in immediate contact with the top surface 36 of the floor panel 20 with a central opening 87 in the gasket 32 being generally aligned with the opening 22 in the floor panel 20. The gasket 32 is preferably made of rubber, but other materials having similar functional sealing characteristics may also be used. The gasket 32 has mounting holes 88 along the perimeter which are provided for attaching the

gasket 32 to the floor panel 20. The mounting holes 88 align with the mounting holes 43 in the bracket 30.

[0032] In using the interconnect device 26 to interconnect cables 24 on opposite sides of the floor panel 20, a cable 24 below the floor panel 20 and/or a connector 60 is attached to the plate 44 by any of the methods described above. A cable 24 above the opening 22 in the floor panel 20 is then interconnected to the cable 24 either by connecting to the connector 60 or to the cable 24 that is attached to the plate 44. The interconnecting of the cables 24 above and below the floor panel 20 are continued until all the cables 24 are interconnected. When interconnecting the cables 24, the cables 24 above the floor panel 20 are routed through the openings in the gasket 42 and in the bracket 30 so that the gasket 32 and the bracket 30 can be attached to the floor panel 20 without pinching any of the cables 24 and the cables 24 above the floor panel 20 pass through the access opening 84 when the cover 28 is attached. After all the cables are interconnected, the gasket 32, the bracket 30, the plate 44 (if a discrete part) and the cover 28 are aligned and attached to the top surface 36 of the floor panel 20. Preferably, the interconnect device 26 is connected to the top surface 36 of the floor panel 20 by screws 90 (for clarity only one screw is shown). However, it should be understood that other means of attaching the interconnect device 26 to the top surface 36 of the floor panel 20, as will be apparent to those skilled in the art, can be used without departing from the scope of the invention as defined by the claims.

[0033] The interconnect device 26 thereby provides a convenient and secure means for interconnecting cables 24 that are routed on opposite sides of the floor panel 20 in an aircraft. Furthermore, the interconnect device 26 can be readily adapted to accommodate various installations, thus eliminating or minimizing many of the problems associated with interconnecting cables that are routed on opposite sides of the floor panel 20.

[0034] The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.